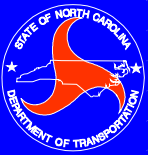


**MAKING WORK ZONES WORK BETTER Through  
Innovations in Technologies, Practices, and Products**

**SMART Work Zones:  
Technology for work zone  
management**

**Steve Kite, PE  
Traffic Control  
Project Engineer**



**North Carolina  
Department of Transportation**



# **FHWA Workzone Facts**

**Between 1980 and 1998, vehicle travel was up 73%, while the number of road miles increased by only 1%.**

**13% of the National Highway System is under construction at any given time.**

**24% of non-recurring congestion is due to work zones.**

**Motorists are less tolerant with delays especially those associated with workzones.**

Resulting in.....



# FHWA Goals

Reduce work zone delay by ensuring all states are engaged in aggressively anticipating and mitigating congestion caused by highway work zones.

## **Actions for use by State Agencies:**

- 1) Develop methods for measuring and monitoring delays in work zones**
- 2) Use available technology to reduce congestion in workzones.**
- 3) Provide automated, real time travel information in advance of the work zones.**



# **What is North Carolina doing?!#**

**NCDOT is proactively deploying the technology to mitigate congestion in highway work zones**

**hmm.....SMART Work  
Zones**

# What is a SMARTZONE and how do they work?

“SMARTZONE” or ‘SMART Work Zone’ is the term commonly used to describe the technology and equipment that monitors and manages traffic congestion due to work zones.

Typically these systems incorporate roadside speed and volume sensors to detect work zone congestion.

This information is then transmitted to an on-site computer via radio, cellular or satellite communication for processing.

The corresponding delay information is displayed on portable changeable message signs in an automated, real-time manner.

In some cases, once the delay exceeds a threshold, alternate route messages may be displayed.



# OUR SMARTZONE GOALS

## Use this Technology to:

Eliminate Fatalities due to excessive traffic queuing in highway work zones.

Virtually eliminate “rear end” crashes due to queues.

Mitigate queues to 2 miles or less.

Provide real time delay information in advance of work areas.

Utilize alternate routes where available to reduce volume thru work area.

**Earn trust with motorists to reestablish compliance with work zone information. We want to exceed our customers' expectations !!**



# How much does it cost?

Depends on how much equipment is necessary to provide the required monitoring.

Depends on length of work zone and if both directions need simultaneous monitoring

Depends on the type of communication technology that is required ( i.e. radio versus cellular and satellite)

Depends on the complexity of the individual vendors system ( i.e. software cost, communication costs, etc.)



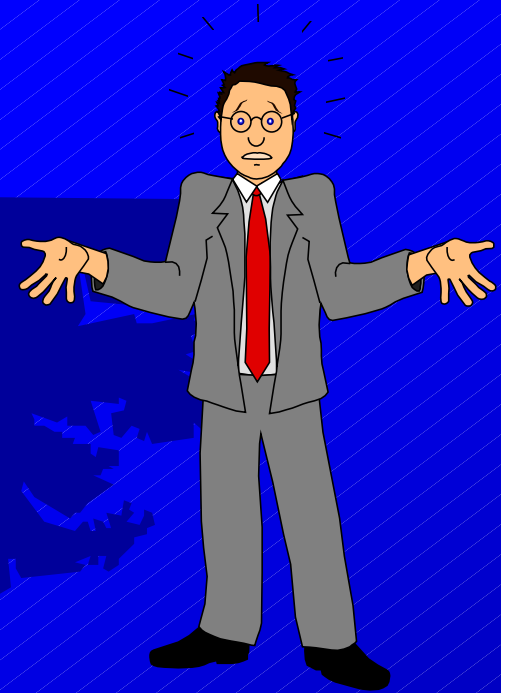
# What are the measurable results?

**Reduction of Congestion associated with lane closures**

**Reduction/elimination of “rear end” crashes due to excessive queuing**

**Reduction/elimination of Fatal Crashes due to excessive queuing**

**Increased Productivity for the Contractor**



# **Intangible Factors**

**Believable, Real Time information resulting in better compliance with work zone information.**


**Better relations with the media industry which in turn is used as the key link to provide information to the public.**

**Improved Communication with the Motoring Public resulting in improved Department Image**

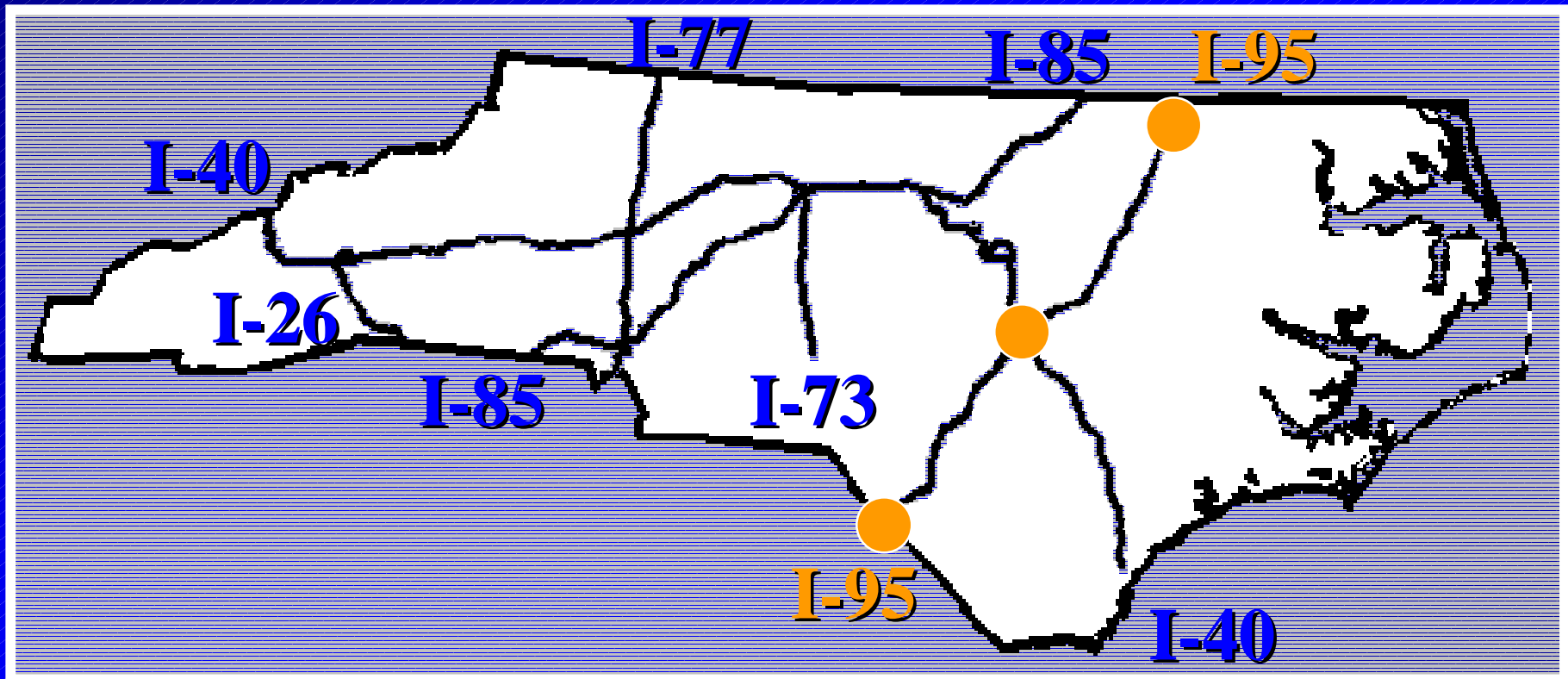
**Regaining the trust from the motoring public....providing them the information they want and need and more importantly...when they need it!**

**SMARTZONE**

**Deployment  
on I-95 near  
Fayetteville, N.C.**

A dark blue silhouette of the state of North Carolina is positioned behind the text. The text is in a bold, yellow, serif font with a black outline. The background of the entire slide is a blue field with a fine, diagonal white line pattern.

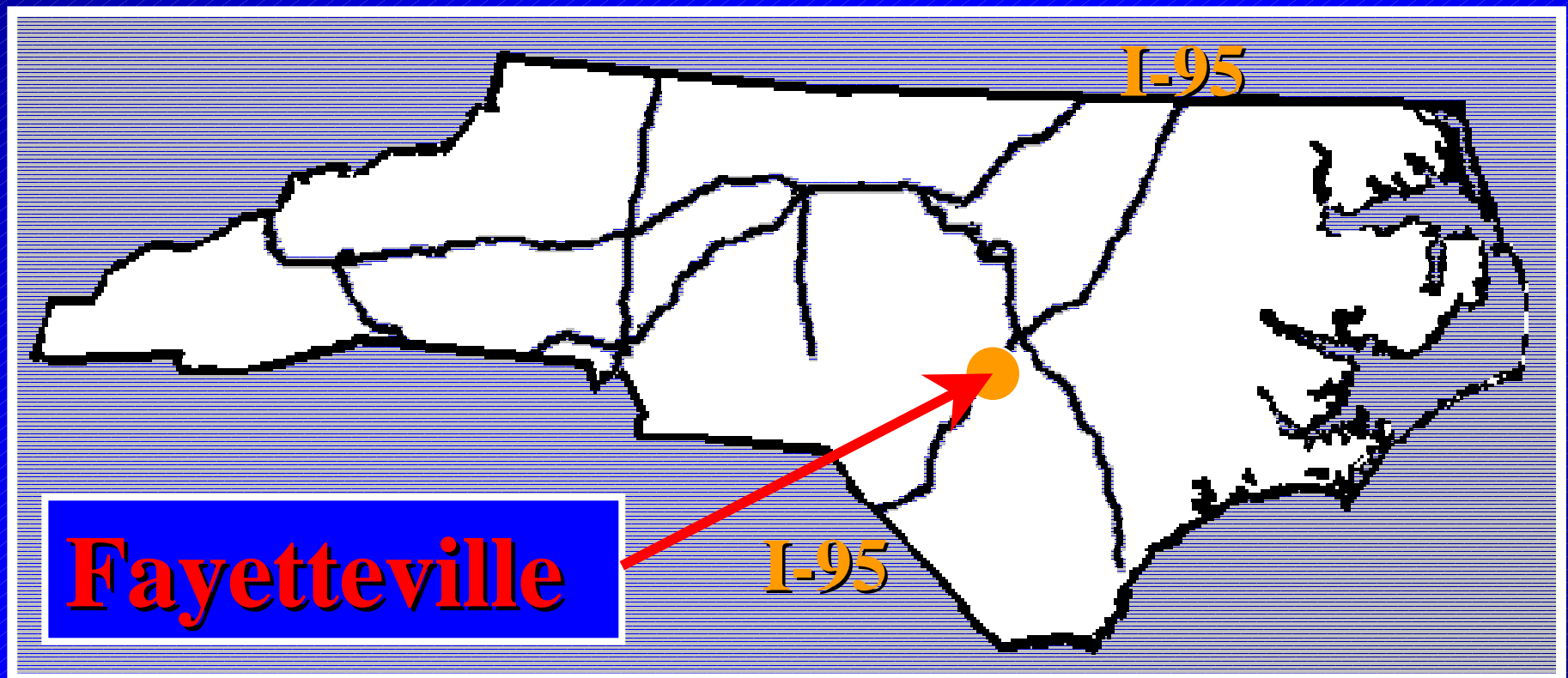
# Interstate Network in North Carolina



Over 80,000 miles of state maintained roads- 2nd largest in the Nation

Over 1000 miles of interstate highway

# North Carolina's first SMARTZONE Deployment on I-95 Near Fayetteville





# SMARTZONE EQUIPMENT



# **I-95 SMARTZONE Deployment**

## **System Requirements**

- **6 speed sensors**
- **8 Changeable Message Signs (2 used on Alternate Routes)**
- **6 cameras (w/ Pan/Tilt/Zoom)**
- **1 Command Center**
- **1 Laptop Computer**
- **Dedicated Project Website**

# **I-95 SMARTZONE**

## **Contract Information**

**I. Contract had 3 pay items**

- **Mobilization**
- **Monthly Rental**
- **Remobilization**

**II. Department Guaranteed 4 months usage with a maximum 10 month duration**

# **I-95 SMARTZONE COSTS**

**Successful Bidder was the Scientex Corporation**

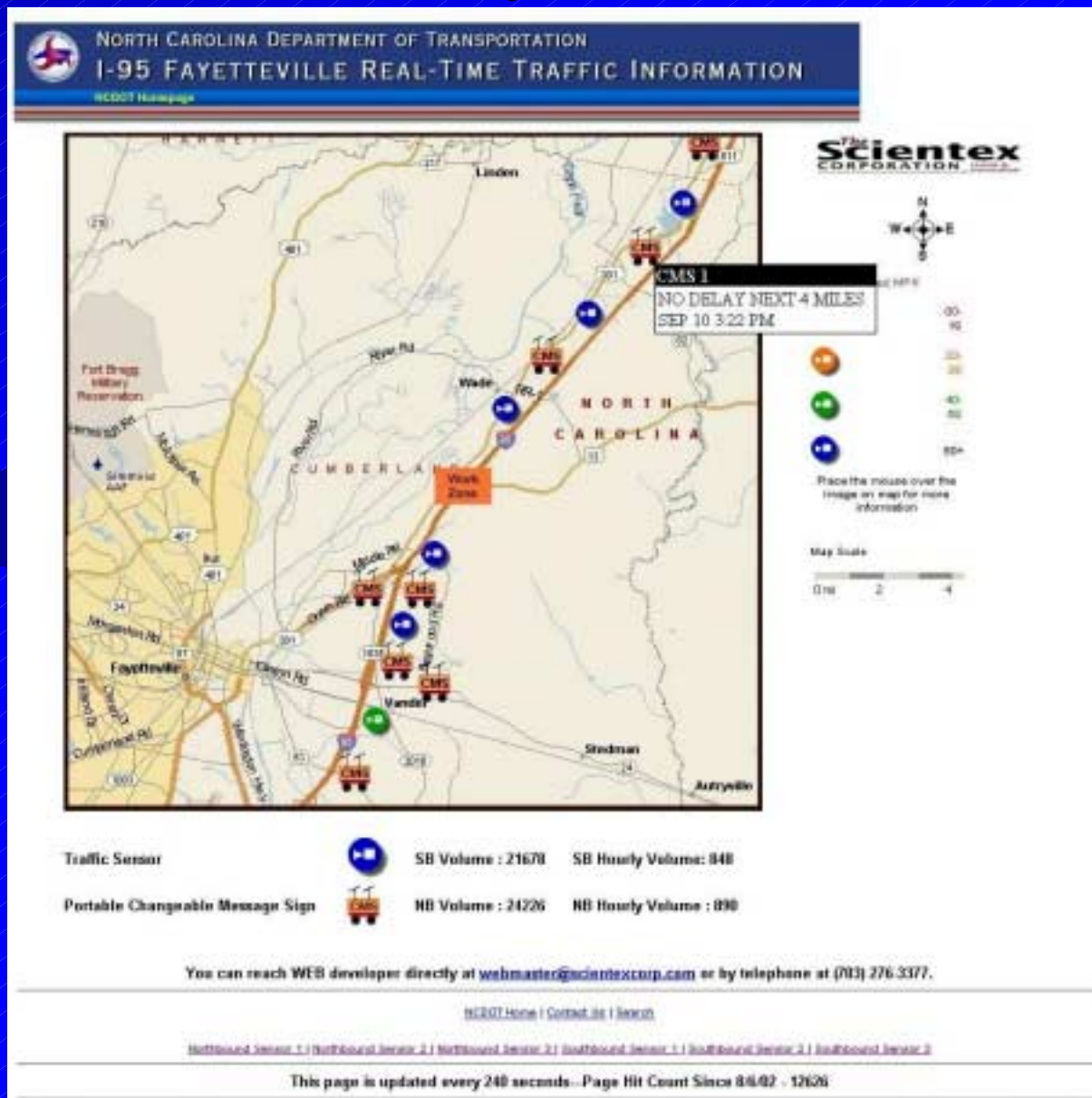
- **Mobilization = \$75,000**
- **Monthly Rental = \$15,000**
- **Remobilization = \$10,000**

**Total Bid = \$235,000.00**

**Current expenditure = \$135,000.00. Project is currently demobilized due to lane closure phase of project is completed**

# Project Website

[www.i95fayetteville.com](http://www.i95fayetteville.com)





# Devices



**Camera trailer with  
Satellite communication**

**Note: Cameras not needed  
for system operation.  
Department Observation  
Purposes Only**



# SMARTZONE DEVICES

**Solar Powered CMS with  
RTMS and Speed Sensor**



**Camera**



**Speed  
Sensor**

# **SMARTZONE- Remote Traffic Microwave Sensor (RTMS) Sensor**

**Traffic Volume Collector**



# COMMAND CENTER



# SMARTZONE COMMUNICATIONS



# REAL TIME INFORMATION



**SLOW  
TRAFFIC  
AHEAD**

7.16.2002



# REAL TIME INFORMATION



7. 16. 2002



# REAL TIME INFORMATION



# REAL TIME INFORMATION



# REAL TIME INFORMATION



# REAL TIME INFORMATION

**ALT.  
ROUTE  
EXIT 61**



7. 16. 2002

# ***I-95 SMARTZONE Results***

**Traffic queues were reduced on average to 2 miles or less. Before deployment, queues were exceeding 5 miles**

**No recorded “rear end” crashes and no Fatalities**

**Delay information was accurate**

**Some utilization of alternate routes**

**A lot of positive response from media and motorists**

# News and Observer Article

July 2, 2002

## Traffic warnings make I-95 cool

By VICKI HYMAN

Until now, I've never found cause to string together the words "North Carolina Department of Transportation" with "cool."

The state has installed its first "smart work zone" on Interstate 95 outside Fayetteville, equipping the highway with sensors to detect speed, calculate traffic conditions and relay real time information to electronic message boards and a Web site.

I'm not talking messages like "Delays Ahead" or "Expect Congestion" that you might see on I-40 around rush hour. With all due respect to the technicians who spend hours monitoring traffic conditions via live feeds from cameras posted along the highway, let me just say, "No duh."

The messages posted on I-95 can tell drivers, to the minute, how long a delay to expect. Once the delay reaches 10 minutes, the electronic message boards offer alternate route information. The state has placed the message boards far enough ahead of the backups to give drivers a way out before they actually hit the traffic.

On the Web site, <http://www.I95fayetteville.com>, you can even view how fast traffic is moving through the work zone.



# ***I-95 SMARTZONE Problems***

**Downtime due to equipment malfunction  
primarily caused by lightening strikes**

**Under-powered camera/sensor equipment**

**Communication problems with cameras. Had to  
utilize satellite communications**

**Availability of speed, volume and video  
information**

# **Future Changes**

**Utilize “on-site” technician**

**Improve Departments access to speed, volume and video information via the website**

**Utilize pay reduction for system downtime**

**Have system notify (via Page, email, cell phone) appropriate personnel if a malfunctions occurs**

**Improve messages on CMS's to enhance ridership on the Alternate Routes**

**So far....what we think we know**

- 1) SMARTZONES “AIN’T” a substitute for sound traffic engineering**
- 2) Need to understand what you want the system to do before you let a contract**

## **Guidelines for application**

**SMARTZONES work well on rural interstates with AADT's up to 55,000 with available alternate routes. Interstate Rehabilitation Projects are ideal!....primarily due to their high frequency of lane closure**

**(continued next page)**

# Guidelines Continued

**SMARTZONES may have applications on roadways with higher AADT's (55,000 to 65,000) where we traditionally restrict lane closures to nightly activity.**

**You may look at using the SMARTZONE technology to mitigate the congestion during non-peak hour flow. Use traditional lane closure restrictions for peak hour.**

**SMARTZONES may have limited applications on high volume roadways (above 65,000) with few reasonable alternate routes. However, if reoccurring congestion is a problem, the technology could provide real time, delay information in lieu of congestion mitigation.**

**SMARTZONES can also be used for more traditional problems such as speeding and site condition problems such as hydroplaning and/or severe alignment concerns.**

# SMARTZONE EVOLUTION...

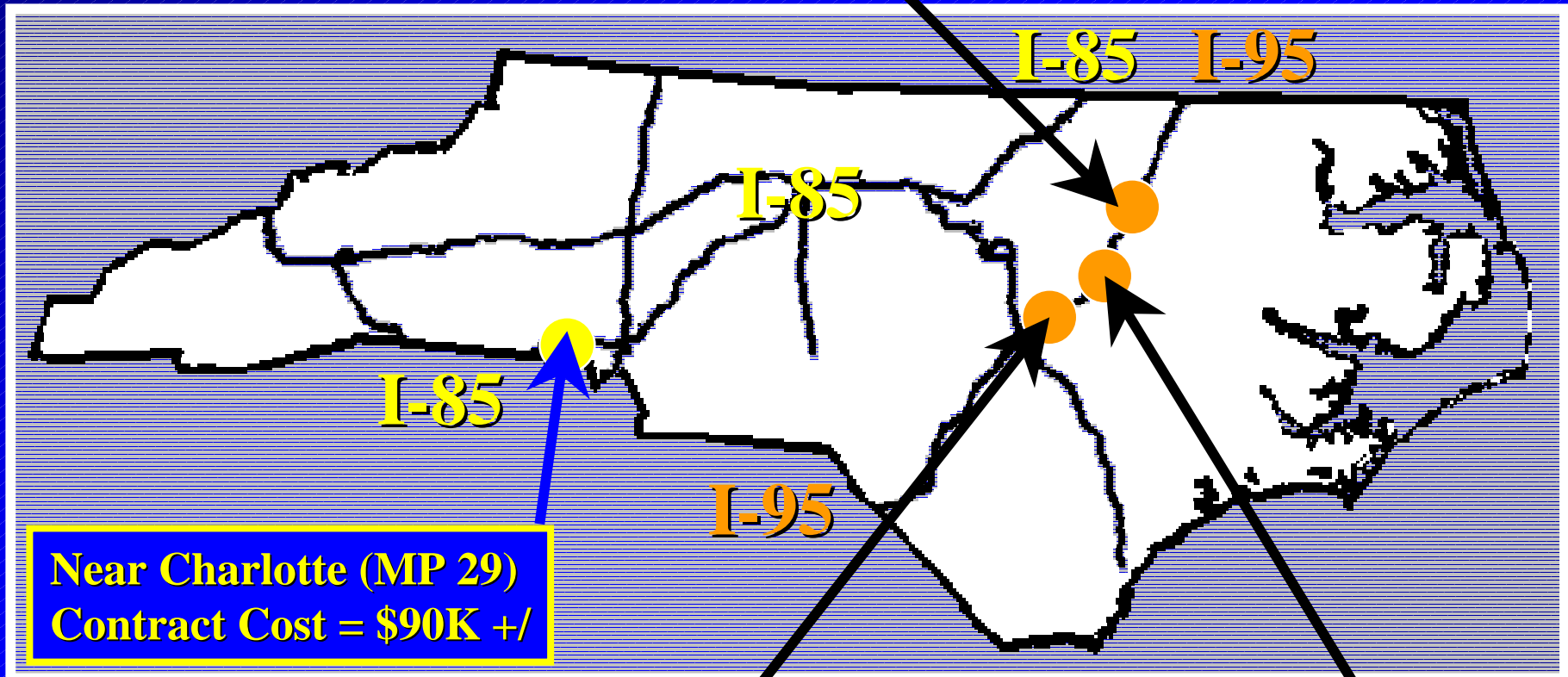
## What have we done and where do we go from here?

- Have completed 1 project deployment on I-95 near Fayetteville
- Have 2 other contracts let on I-95 in Div. 4 that should be deployed within the next 30 days...**with moving alternate route locations!**
- Currently working on another contract for deployment on I-95 in Johnston County near Four Oaks
- Will soon be using this technology to help hydroplaning and speeding issues on I-85 outside of Charlotte

# Future SMARTZONE Deployments

Near Rocky Mt. (MP 145)

Contract Cost = \$264,500



Near Charlotte (MP 29)  
Contract Cost = \$90K +/-

Near Smithfield (MP 87)

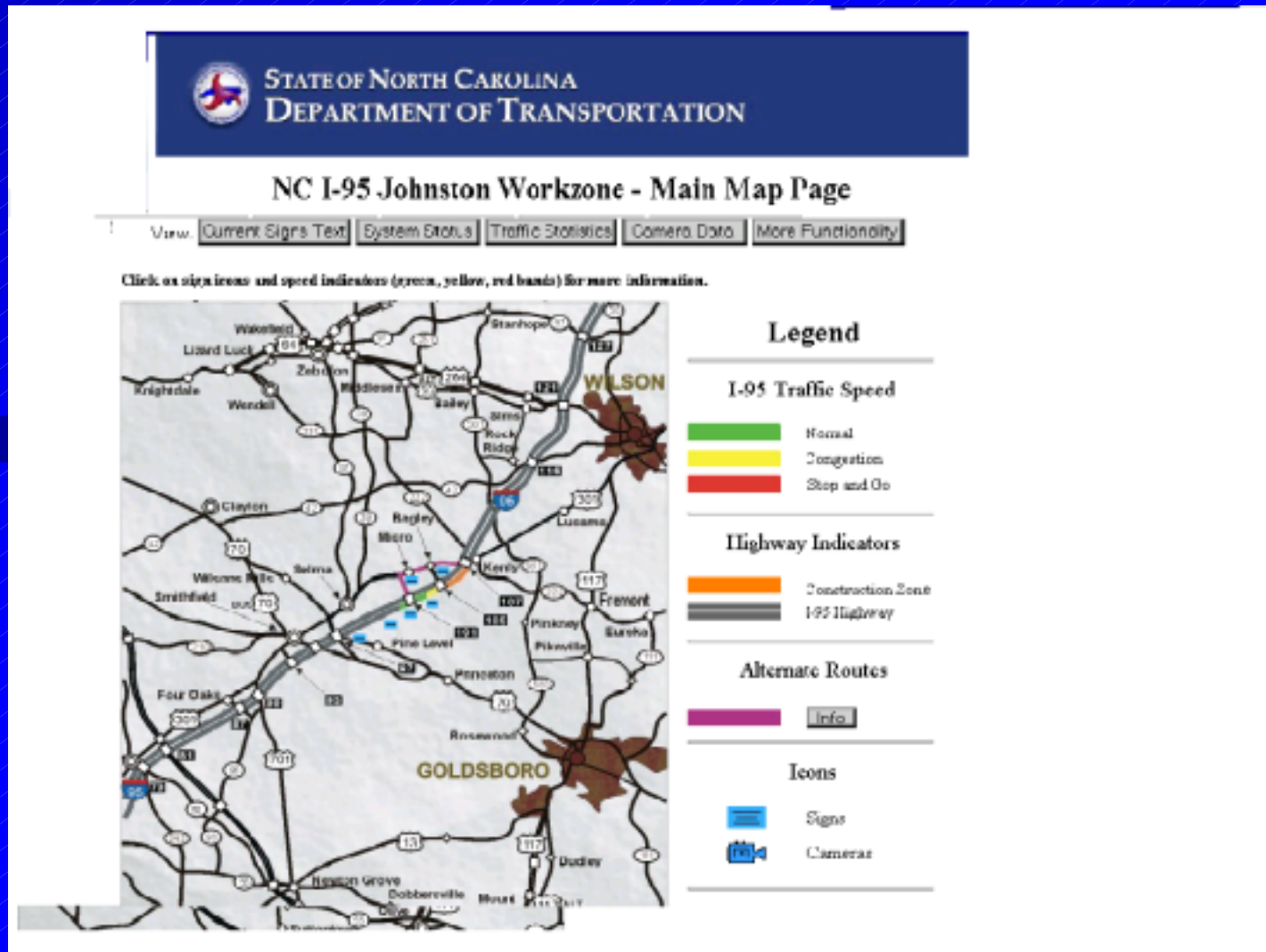
Contract Cost = N/A

Near Kenly (MP 107)

Contract Cost = \$178,850



# I-95 Johnston Cty. SMARTZONE



# I-95 Johnston Cty SMARTZONE

View Current Signs Page - Netscape

File Edit View Go Bookmarks Tools Window Help

https://tn100.idinc.com/nc95john/dot/ViewCurrentSigns.asp Search

Mail Home Radio My Netscape Search Bookmarks Members WebMail Connections BizJournal SmartUpdate Marketplace

View: **Current Signs Text** System Status Traffic Statistics Camera Data More Functionality

**Northbound**

Each road sign is capable of having 3 different messages scroll across the screen.  
Below are the messages currently being displayed on each sign.  
Values shown in red are not current.

<b>Sign 1</b>	5/12/2003 5:06:25 PM	TRAFFIC STOPPED AHEAD	10 MINUTE DELAY	NO ALT. ROUTE
<b>Sign 2</b>	5/12/2003 5:06:25 PM	TRAFFIC STOPPED AHEAD	10 MINUTE DELAY	NO ALT. ROUTE
<b>Sign 3</b>	5/12/2003 5:06:25 PM			
<b>Sign 4</b>	5/12/2003 5:06:25 PM	9 MIN. DELAY AHEAD	PREPARE TO STOP	
<b>Sign 5</b>	5/12/2003 5:06:25 PM	??	??	??
<b>Sign 6</b>	5/12/2003 5:06:25 PM	??	??	??

Sending request to tn100.idinc.com...

Start Kite J. S. (S. - M...) Inbox - Netscap... Exploring - 2003... Microsoft Power... View Current... Microsoft Word... johnston smartzo... 5:06 PM

# I-85 Hydroplane System

**News - NCDOT Installs Wet Pavement Detection System On Interstate 85 - Netscape**

File Edit View Go Communicator Help

Back Forward Reload Home Search Guide Print Security Shop Stop Netscape

Bookmarks Location: <http://www.itsa.org/itsnews.nsf/key/A41A70perDocument> What's Related

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**NCDOT Installs Wet Pavement Detection System On Interstate 85**  
*System to Improve Safety During Heavy Rains*

RALEIGH, NC, May 7, 2003 - State Highway Administrator Len Sanderson today announced a special safety feature in the I-85 work zone in western Mecklenburg County. To improve safety for motorists, the N.C. Department of Transportation (NCDOT) has installed a wet pavement detection system on Interstate 85 from mile marker 28 to mile marker 30 in Mecklenburg County.

The wet pavement detection system has sensors that detect moisture on the roadway. Once moisture is detected, the system automatically activates a message on portable, changeable message signs to warn motorists of the upcoming road condition.

"Safety is the department's number one priority and the wet pavement detection system is another effort the department is taking to increase safety in North Carolina work zones," said Sanderson. "Because driving conditions can vary in work zones, it is imperative for motorists to pay attention and slow down, especially during inclement weather."

The system was installed at the end of March because of excessive standing water on the pavement between mile marker 28 and 30.

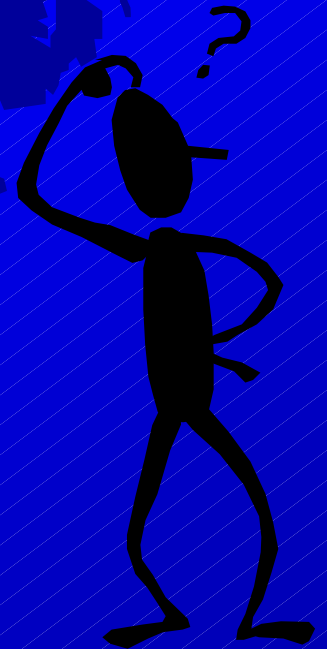
Motorists traveling this section of I-85 during heavy rains should slow down and use extra caution.

Microsoft

Start Kite J. S. I. ... Inbox - Net ... Exploring - ... Microsoft P... View Cure... Microsoft ... johnston s... Fwd: A Bk ... News - ... 5:11 PM

# **SMARTZONES- The technology for workzone management**

**Questions/Comments?**



# How does it work?

**SMARTZONES incorporate roadside speed and volume sensors to detect slow-downs.**

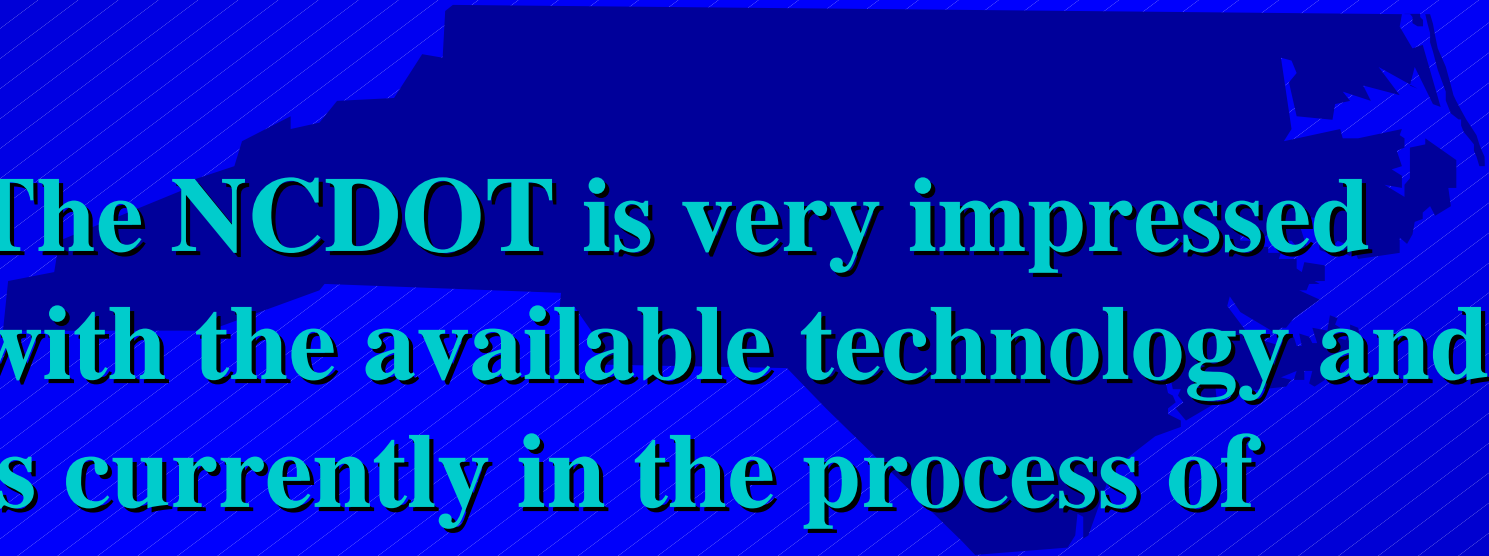
**This information is then transmitted to an on-site computer via radio, cellular or satellite communication for processing.**

**Delay information is then transmitted from the computer to portable Changeable Message Signs**



**Success?**

**You bet!**

A faint, light blue map of North Carolina is visible in the background, centered behind the text.

**The NCDOT is very impressed  
with the available technology and  
is currently in the process of  
installing 2 more 'SMARTZONES'  
on I-95**



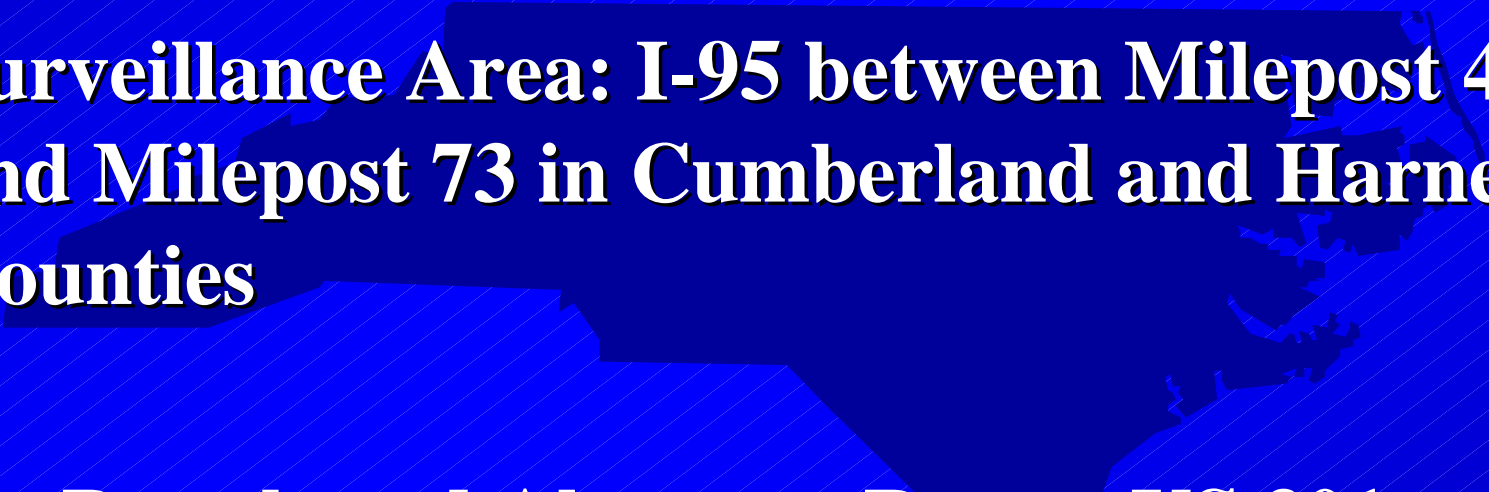
# Traffic !@\$%



# **I-95 SMARTZONE Deployment**

**Workzone is located at Milepost 58**

**Surveillance Area: I-95 between Milepost 46 and Milepost 73 in Cumberland and Harnett Counties**

A map of North Carolina is shown in the background, with a red line indicating the path of I-95. The workzone is highlighted in red along I-95 between mileposts 46 and 73, which corresponds to Cumberland and Harnett counties.

**Preselected Alternate Route: US 301.**

**Northbound Exit 55**

**Southbound Exits 61 and 65**